CLAIMS

1. A three-dimensional image display device comprising:

a two-dimensional image display screen having color filters in which each color is disposed on sub-pixels obtained by dividing one pixel in a vertical direction and same color is disposed on each column of sub-pixels;

an optical plate having an exit pupil, the exit pupil being provided for making a viewing zone different for each pixel and having a longitudinal axis disposed as to be inclined from a vertical direction of the two-dimensional image display screen at a degree (θ) ($\theta \neq 0$, $-45° < \theta < 45°$), the viewing zone being a region in which parallax information displayed on the two-dimensional image display screen is observed; and

a viewing zone adjusting unit that adjusts the viewing zone by shifting the viewing zone in a horizontal direction of the two-dimensional image display screen by shifting the parallax information disposed on each pixel of the two-dimensional image display screen in the vertical direction by pixel.

2. The three-dimensional image display device according to claim 1, wherein the viewing zone adjusting unit shifts the viewing zone in the horizontal direction by further shifting the parallax information in the horizontal direction by pixel.

3. The three-dimensional image display device according to claim 2, further comprising:

a shift direction determining unit that determines whether to shift the parallax information in the vertical direction or the horizontal direction, according to a shift

amount of the viewing zone to be shifted by the viewing zone adjusting unit, wherein

the viewing zone adjusting unit shifts the parallax information in the shift direction by the number of pixels according to the shift amount.

4. The three-dimensional image display device according to claim 1, wherein

the longitudinal axis of the exit pupil of the optical plate is disposed in a direction inclined from the vertical direction of the two-dimensional image display screen at a degree ($-45° < \theta < 0°$), and

the viewing zone adjusting unit shifts the parallax information from top to bottom in the vertical direction by pixel, when shifting the viewing zone from a right side to a left side when viewed from an observer side in the horizontal direction of the two-dimensional image display screen.

5. The three-dimensional image display device according to claim 1, wherein

the optical plate is disposed in a direction inclined from the vertical direction of the two-dimensional image display screen at a degree ($-45° < \theta < 0°$), and

the viewing zone adjusting unit shifts the parallax information from bottom to top in the vertical direction by pixel, when shifting the viewing zone from a left side to a right side when viewed from an observer side in the horizontal direction of the two-dimensional image display screen.

6. The three-dimensional image display device according to claim 1, wherein

the optical plate is disposed in a direction inclined from the vertical direction of the two-dimensional image display screen by a degree ($0° < \theta < 45°$), and

the viewing zone adjusting unit shifts the parallax information from bottom to top in the vertical direction by pixel, when shifting the viewing zone from a right side to a left side when viewed from an observer side in the horizontal direction of the two-dimensional image display screen.

7. The three-dimensional image display device according to claim 1, wherein

the optical plate is disposed in a direction inclined from the vertical direction of the two-dimensional image display screen at a degree ($0° < \theta < 45°$), and

the viewing zone adjusting unit shifts the parallax information from top to bottom in the vertical direction by pixel, when shifting the viewing zone from a left side to a right side when viewed from an observer side in the horizontal direction of the two-dimensional image display screen.

8. The three-dimensional image display device according to claim 1, further comprising:

an viewing position displacement detecting unit that detects an viewing position displacement amount which is a displacement amount between an viewing position on which a three-dimensional image displayed on the three-dimensional image display device should be observed and an actual position of an observer; and

an viewing zone shift amount determining unit that determines a shift amount of the viewing zone based on the viewing position displacement amount, wherein

the viewing zone adjusting unit shifts the viewing zone by the shift amount.

9. The three-dimensional image display device according to claim 8, further comprising:

the viewing position holding unit that holds the viewing position, wherein

the viewing position displacement detecting unit recognizes a position of the observer by image recognition, and detects a difference value between the recognized position of the observer and the viewing position held by the viewing position holding unit as the viewing position displacement amount.

10. The three-dimensional image display device according to claim 8, wherein

the viewing position displacement detecting unit detects the viewing position displacement amount in the horizontal direction of the two-dimensional image display screen, and

the viewing zone shift amount determining unit determines the shift amount of the viewing zone based on the viewing position displacement amount in the horizontal direction.

11. The three-dimensional image displaying device according to claim 8, wherein

the viewing position displacement detecting unit detects the viewing position displacement amount in the vertical direction of the two-dimensional image display screen, and

the viewing zone shift amount determining unit determines the shift amount of the viewing zone based on

the viewing position displacement amount in the vertical direction.

12. The three-dimensional image display device according to claim 8, further comprising:

an inclination detecting unit that detects an inclination of the two-dimensional image display screen; and

a viewing zone shift amount determining unit that determines the shift amount of the viewing zone based on the inclination, wherein

the viewing zone adjusting unit shifts the viewing zone by the shift amount.

13. The three-dimensional image display device according to claim 1, further comprising:

an optical plate position displacement amount obtaining unit that obtains from outside an optical plate position displacement amount which is a displacement amount between the two-dimensional image display screen and the optical plate; and

a viewing zone shift amount determining unit that determines the shift amount of the viewing zone based on the optical plate position displacement amount, wherein

the viewing zone adjusting unit shifts the viewing zone by the viewing zone shift amount.

14. The three-dimensional image display device according to claim 1, further comprising a surplus portion processing unit that disposes the parallax information on a pixel, which is located on the two-dimensional display screen and on which the parallax information is not disposed after the shift of the parallax information.

15. The three-dimensional image display device according to claim 1, further comprising a surplus portion processing unit that disposes a black image on a pixel, which is located on the two-dimensional display screen and on which the parallax information is not disposed after the shift of the parallax information.

16. The three-dimensional image display device according to claim 1, further comprising:

a parallax information holding unit that holds the parallax information, a size of which is larger than a size of the two-dimensional image display screen, wherein

the two-dimensional image display screen displays the parallax information held by the parallax information holding unit.

17. The three-dimensional image display device according to claim 16, further comprising

a parallax information preparing unit that prepares the parallax information, the size of which is larger than the size of the two-dimensional image display screen, wherein

the parallax information holding unit holds the parallax information prepared by the parallax information preparing unit.

18. A method of displaying a three-dimensional image comprising:

in a three-dimensional image display device including

a two-dimensional image display screen having color filters in which each color is disposed on sub-pixels obtained by dividing one pixel in a vertical direction and

same color is disposed on each column of sub-pixels, and

an optical plate having an exit pupil, the exit pupil being provided for making a viewing zone different for each pixel and having a longitudinal axis disposed as to be inclined from a vertical direction of the two-dimensional image display screen at a degree (θ) ($\theta \neq 0$, $-45° < \theta < 45°$), the viewing zone being a region in which parallax information displayed on the two-dimensional image display screen is observed,

shifting the viewing zone in a horizontal direction of the two-dimensional image display screen by shifting the parallax information disposed on each pixel of the two-dimensional image display screen in the vertical direction by pixel.

19. A computer program product having a computer readable medium including programmed instructions, wherein the instructions, when executed by a computer, cause the computer to perform:

in a three-dimensional image display device including

a two-dimensional image display screen having color filters in which each color is disposed on sub-pixels obtained by dividing one pixel in a vertical direction and same color is disposed on each column of sub-pixels, and

an optical plate having an exit pupil, the exit pupil being provided for making a viewing zone different for each pixel and having a longitudinal axis disposed as to be inclined from a vertical direction of the two-dimensional image display screen at a degree (θ) ($\theta \neq 0$, $-45° < \theta < 45°$), the viewing zone being a region in which parallax information displayed on the two-dimensional image display screen is observed,

shifting the viewing zone in a horizontal direction of the two-dimensional image display screen by shifting the parallax information disposed on each pixel of the two-dimensional image display screen in the vertical direction by pixel.